

AE-05-05 ADVANCED TECHNOLOGY AND SYSTEMS ASSESSMENT

AKB	WATER USE INFORMATION SYSTEM	JF FLETCHER	\$ 100K
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AF-10-25 GAS CDDLED FAST BREEDER REACTDR DEVELOPMENT

AKS	GCFR STRUCTURAL MATERIALS	LD BLACKBURN	\$ 20K
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AG-40-10-05 LWR FUEL CYCLE

ALA	HYBRID FUEL FABRICATION	DW BENNETT	\$ 750K
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AR-05-10-02 DEFENSE WASTE MANAGEMENT

AKC	ACID DIGESTION (LOW LEVEL)	CR ALLEN	\$ 1500K
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AT-15-30-31 FUSION REACTOR MATERIALS

AKH	FUSION ALLOY DEVELOPMENT	GL WIRE	\$ 750K
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AT-15-30-33 FUSIDN REACTDR MATERIALS

ALT	SOLID TRITIUM BREEDER DEVELOPMENT	ET WEBER	\$ 200K
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AT-15-30-34 FUSIDN REACTOR MATERIALS

AKJ	IRRADIATION EFFECTS ANALYSIS	DG DORAN	\$ 700K
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HA-01-03-04 REGIONAL ASSESSMENT

ALR	OTT WATER RESOURCE STUDIES	JF FLETCHER	\$ 25K
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SPECIAL REQUESTS CLINCH RIVER BREEDER REACTOR PROJECT

EBA	CRBRP REACTOR SYSTEMS THERMAL HYDRAULIC TESTING	WL THORNE	\$ 890K
EBC	CRBRP FUEL FAILURE MONITORING	JJ McCOWN	

SUBTOTAL	\$ 980K
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SPECIAL REQUESTS NUCLEAR REGULATORY COMMISSION

EAA	SHIPPING CASK ANALYSIS	JF FLETCHER	\$ 120K
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QUESTS	OTHER		
CA		NATIONAL WASTE TERMINAL STORAGE PROGRAM	\$ 924K
		AND SPENT FUEL ENGINEERING	
CB		FUSION REACTOR SAFETY SUPPORT STUDIES	LD MUHLESTEIN 441
			<u>SUBTOTAL \$1365K</u>
			<u>TOTAL \$7262K</u>

REACTOR CORE SUPPLY - TT NAGAMOTO

HYBRID FUEL FABRICATION
LOFT ADVANCED FUEL ROD INSTRUMENTATION
DEVELOPMENT

DW BENNETT
EM SHEEN

\$ 750K
164

SUBTOTAL \$ 914K

REACTOR CORE EVALUATION - CM COX

SOLID TRITIUM BREEDER DEVELOPMENT

ET WEBER

\$ 200K

REACTOR CORE TECHNOLOGY - HH YOSHIKAWA

WATER USE INFORMATION SYSTEM
ACID DIGESTION (LOW LEVEL)
FUSION ALLOY DEVELOPMENT
IRRADIATION EFFECTS ANALYSIS
GAS COOLED FAST REACTOR STRUCTURAL
MATERIALS

JF FLETCHER
CK ALLEN
GL WIRE
DG DORAN
LD BLACKBURN

\$ 100K
1500
750
700
20

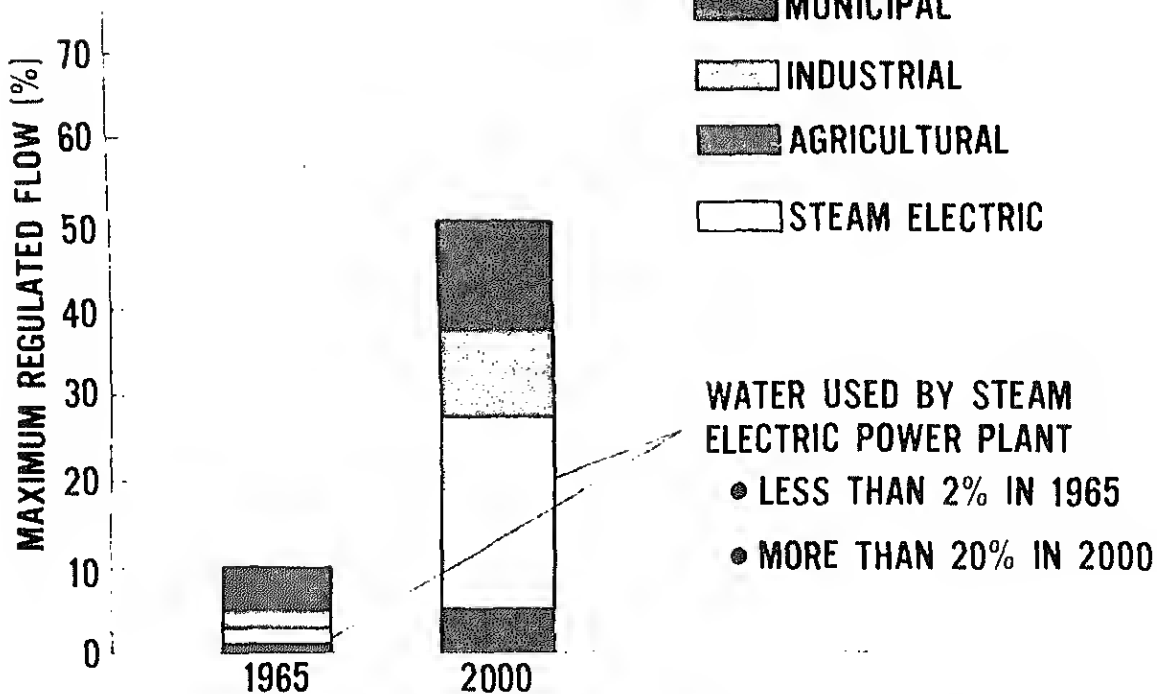
OTI WATER RESOURCE STUDIES
SHIPPING CASK ANALYSIS
LWR NEUTRON DOSIMETRY
CRBRP REACTOR SYSTEMS THERMAL HYDRAULIC
TESTING
CRBRP FUEL FAILURE MONITORING
NATIONAL WASTE TERMINAL STORAGE PROGRAM
AND SPENT FUEL ENGINEERING
FUSION REACTOR SAFETY SUPPORT STUDIES

JF FLETCHER
JF FLETCHER
WN McELROY
WL THORNE
JJ McCOWN
RJ CASH
LD MUEHLESTEIN

25
120
588
890
90
924
441

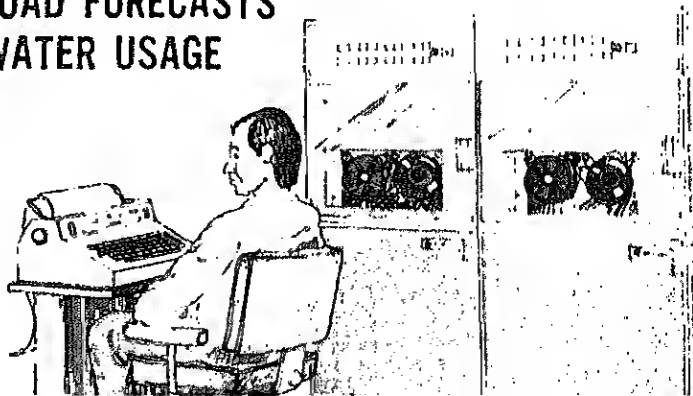
SUBTOTAL \$ 6148K

TOTAL \$ 7262K



WATER USE INFORMATION SYSTEM

- INDIVIDUAL POWER PLANT CHARACTERISTICS
- REGIONAL HYDRAULIC DATA
- WATER RIGHTS
- REGIONAL LOAD FORECASTS
- REGIONAL WATER USAGE



OBJECTIVE

Provide data and evaluations on water resource availability in support of the advanced cooling systems program.

SCOPE

Develop and operate the computerized Water Use Information System. Perform national and regional water resource evaluations at DOE request.

RECENT TECHNICAL HIGHLIGHTS

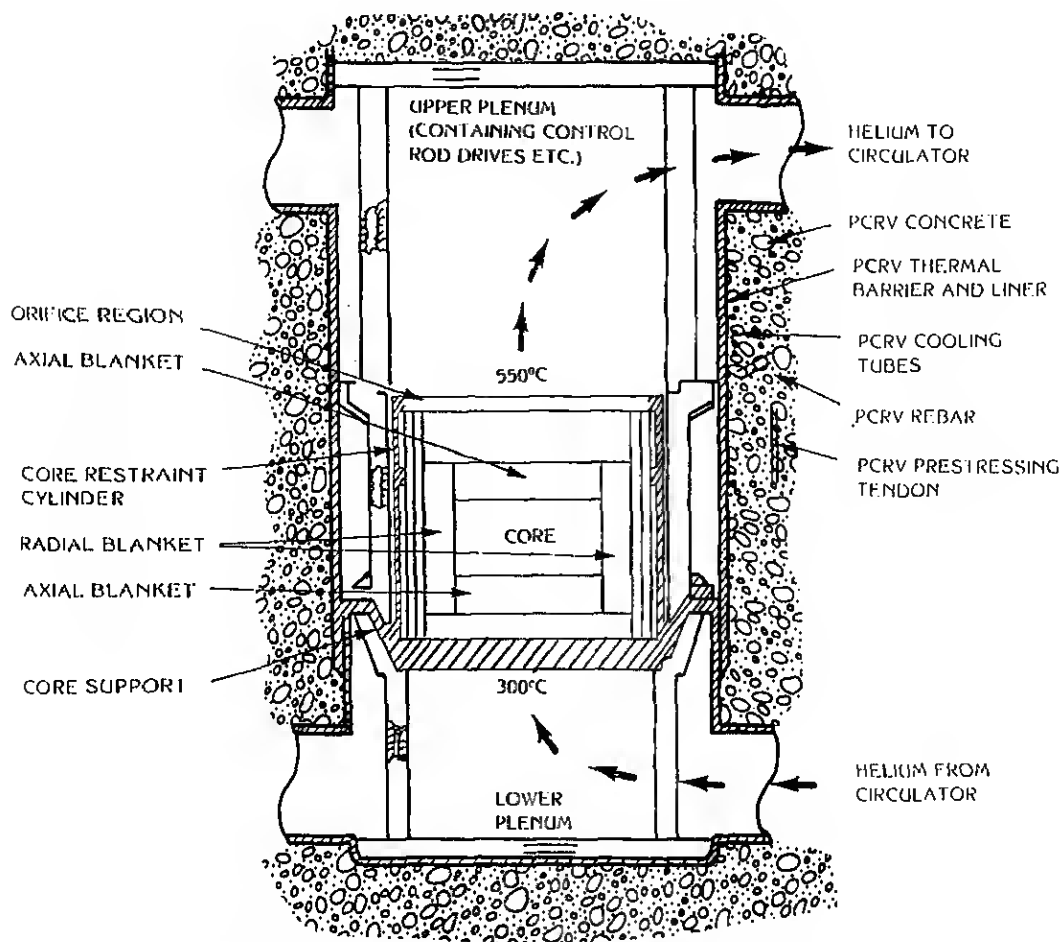
DND, an econometric predictive model for electricity demand, was completed and used in regional water resource evaluations.

A cursory water resources evaluation of national and regional water availability for power plant cooling was completed.

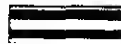
EXPECTED NEAR-TERM ACCOMPLISHMENTS

An updated, detailed study of national and regional water availability for power plant cooling will be completed.

CROSS SECTION OF GCFR DEMONSTRATION PLANT REACTOR CAVITY



STRUCTURAL
STEEL



LAMINATED
SHIELDING

Manager: L.D. Blackburn
Sub-Department: Technology

FY-81: \$ 20K

Customer:
Organization: DOE/RRT
Contact: G.A. Newby
Program: Gas Cooled Fast
Breeder Reactor
Development
AF-10-25

OBJECTIVE

Provide mechanical property data on irradiated and unirradiated materials to support the design, safety analyses, and operation of GCFR out-of-core components.

SCOPE

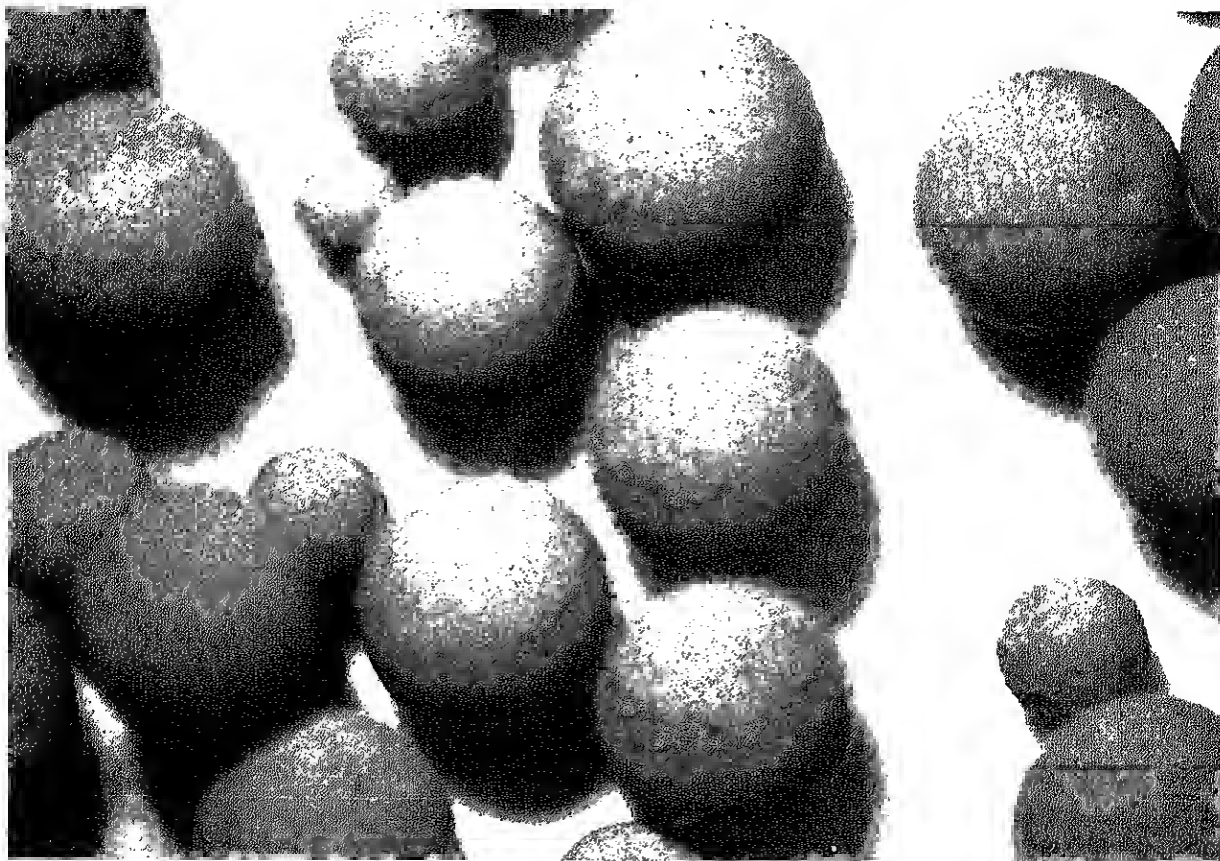
Conduct irradiations and testing to determine strength, ductility, fatigue crack propagation and fracture toughness of selected materials.

RECENT TECHNICAL HIGHLIGHTS

EBR-II irradiation of three pins and postirradiation tension testing to determine high temperature fluence limits for 316 SS materials was completed.

Characterization of fatigue crack propagation in two ferritic steels, modified 9Cr-1Mo and HT-9, was completed.

GEL SPHERES



UNSINTERED ~40X

FY-81: \$ 750K

Contact: W.W. Dandridge
Program: LWR Fuel Cycle
AG-40-10-05

OBJECTIVE

Evaluate the equipment required for fabrication of breeder reactor pellet fuels from an alternate conversion source.

SCOPE

Adapt equipment used to fabricate fuel pellets from mixed oxide powder to make fuel from gel-spheres produced by the internal gelation method.

Adapt as necessary automated analytical chemistry techniques, waste/scrap processing and handling systems to accommodate gel/sphere processing.

RECENT TECHNICAL HIGHLIGHTS

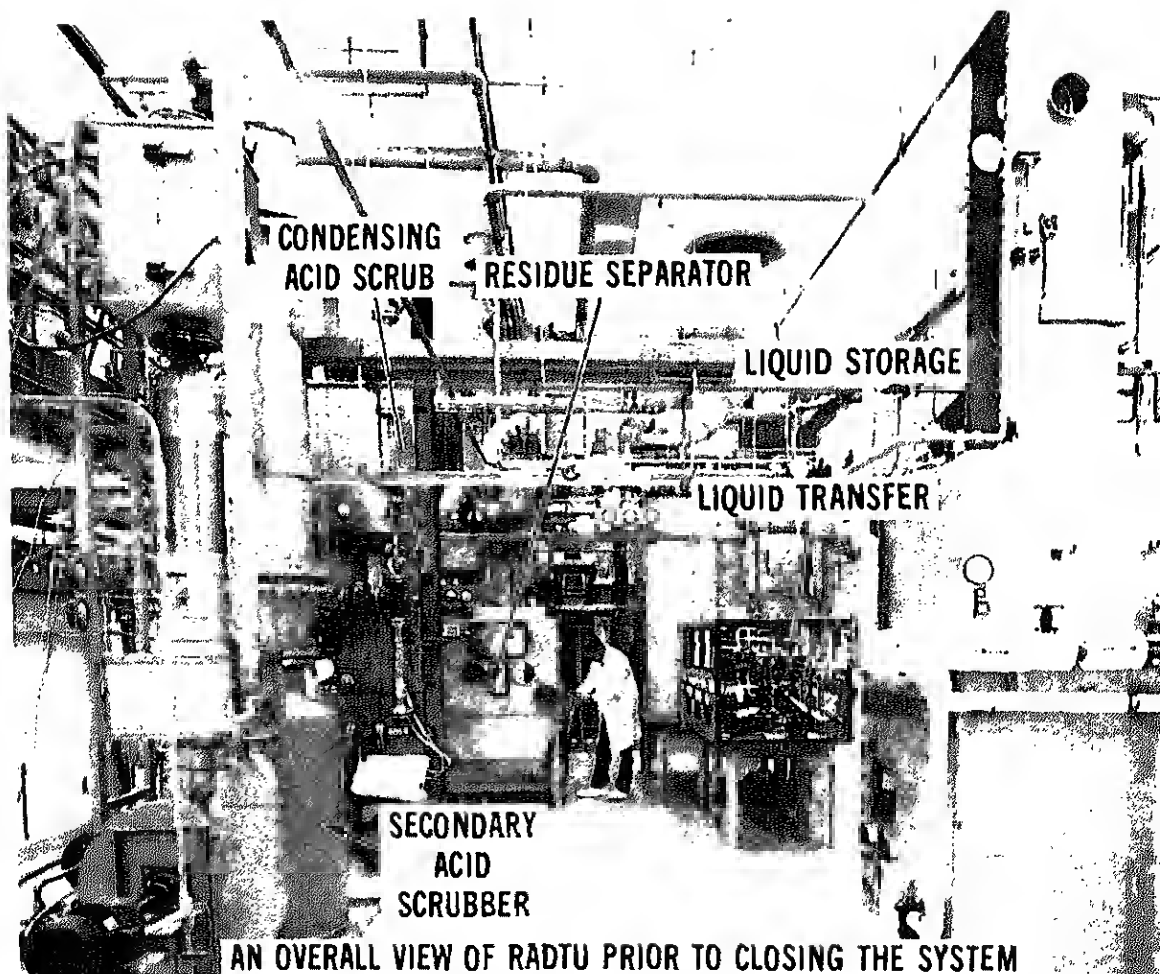
The first sample of gel-spheres was received and is being evaluated and analyzed.
Press feeding system was designed and fabricated.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Transporting and feeding tests will be conducted with spheres.

Press feed system will be demonstrated.

Cost comparison data will be established.



CONDENSING
ACID SCRUB

RESIDUE SEPARATOR

LIQUID STORAGE

LIQUID TRANSFER

SECONDARY
ACID
SCRUBBER

AN OVERALL VIEW OF RADTU PRIOR TO CLOSING THE SYSTEM

Manager: C.R. Allen
Sub-Department: Technology

FY-81: \$ 1500K

Customer:
Organization: DOE/RL
Contact: G. Miskho/W.C. Johnson
Program: Defense Waste Management
AR-05-10-02-F

OBJECTIVE

Process Z-plant transuranic waste and scrap. Demonstrate capability of acid digestion system to process various waste and scrap forms.

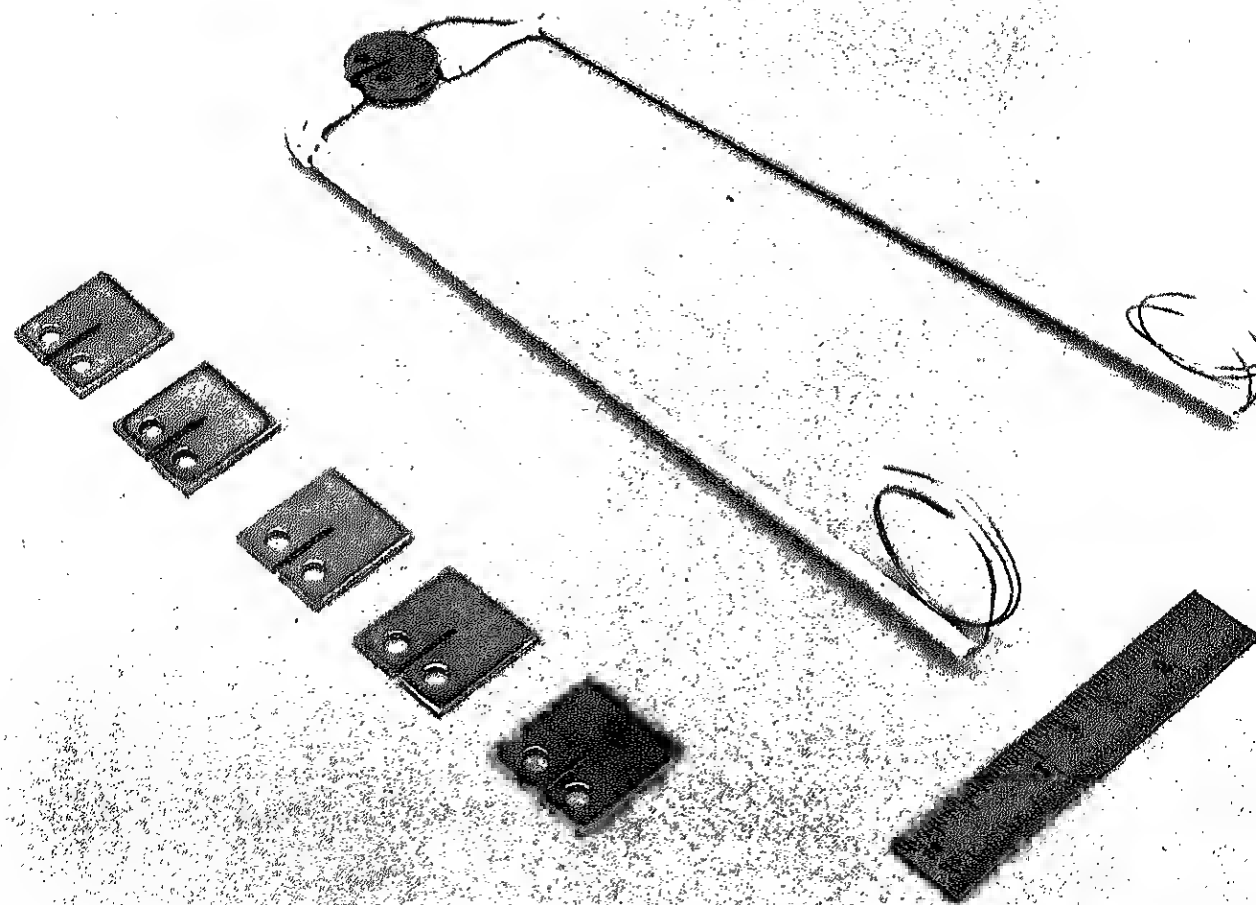
SCOPE

Demonstrate capability of the Radioactive Acid Digestion Test Unit (RADTU) to process Z-plant waste, D&D waste, and special waste forms.

RECENT TECHNICAL HIGHLIGHTS

High rate digester equipment was installed and tested to increase system capacity to 10 kg waste/hr. Centrifuge and air classification equipment was installed and tested. Radioactive operation was restarted in June, 1980.

International workshop on acid digestion was held at HEDL in October, 1980.



MAGNETIC FUSION ENERGY-5 (MFE-5) IN
REACTOR FATIGUE CRACK GROWTH EXPERIMENT

OBJECTIVE

Develop, characterize and qualify materials for fusion reactor wall applications.

SCOPE

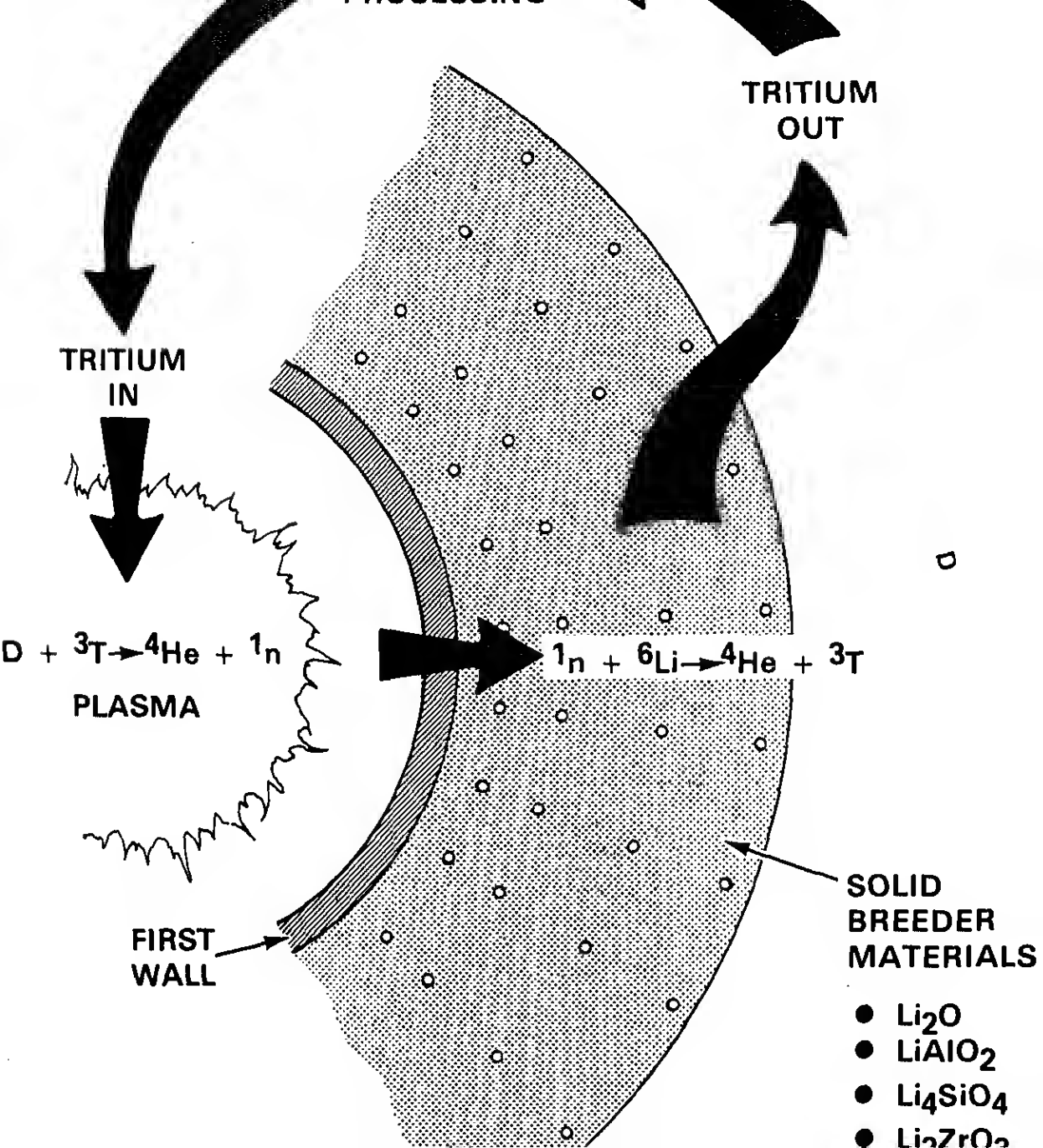
Test and analyze irradiated materials to determine fatigue, fracture toughness, swelling and creep.

RECENT TECHNICAL HIGHLIGHTS

Fabrication of the world's first MFE-5 in-reactor fatigue and crack growth experiment is completed and the test assembly is ready for insertion into the Oak Ridge Research Reactor.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Irradiation of the MFE-5 experiment in the Oak Ridge Research Reactor will be started. Post irradiation fatigue crack growth tests on titanium will be started.



Manager: E.T. Weber
Sub-Department: Core Evaluation
FY-81: \$ 200K

Customer:
Organization: DOE/OFE
Contact: T.C. Reuther
Program: Fusion Reactor Materials
AT-15-30-33

OBJECTIVE

Develop, characterize and qualify blanket materials for fusion reactor applications.

SCOPE

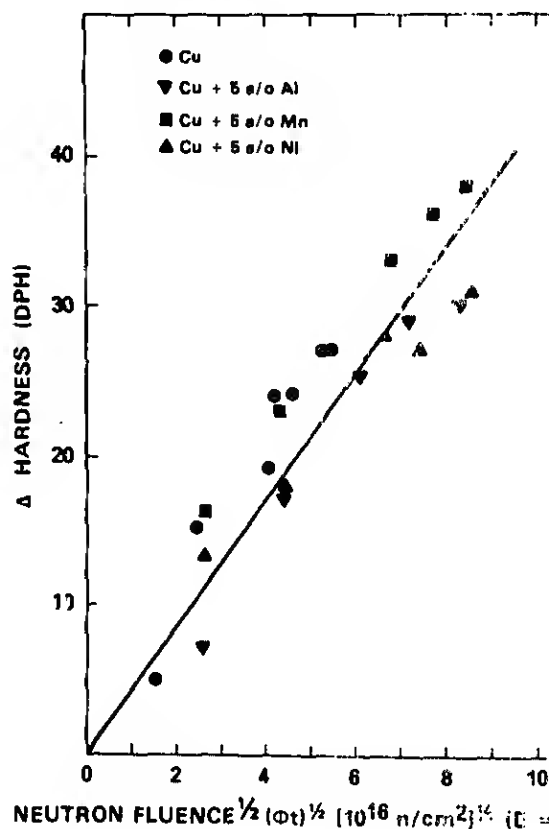
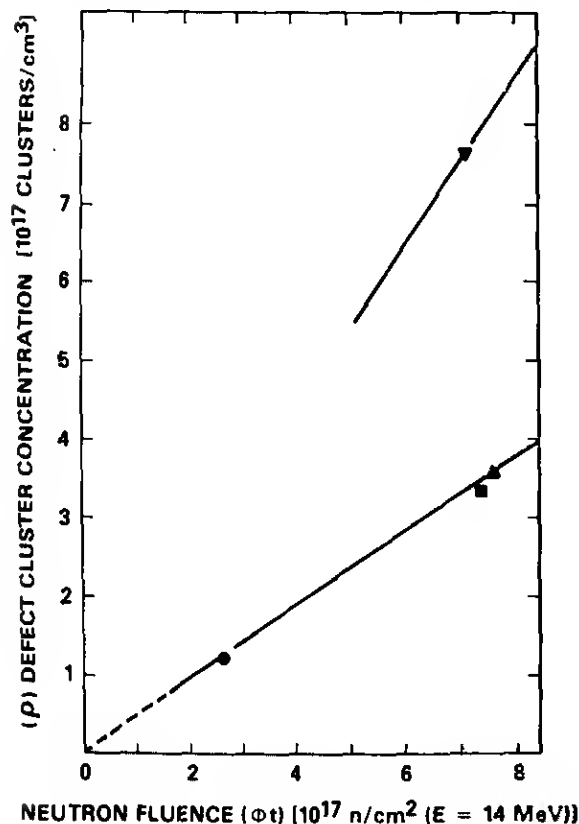
Fabricate, irradiate and analyze lithium ceramic materials for fusion blanket.

RECENT TECHNICAL HIGHLIGHTS

Technical feasibility for a Fusion Breeder Materials Irradiation experiment in EBR-II has been established.

INDICATES THAT ALLOY ADDITIONS INFLUENCE VISIBILITY OF DEFECT CLUSTERS

(14 MeV NEUTRONS; 25°C IRRADIATION TEMP.)



OBJECTIVE

Clarify fundamental processes controlling material response to irradiation and develop correlations for extrapolation of fission-generated data base to fusion environments.

SCOPE

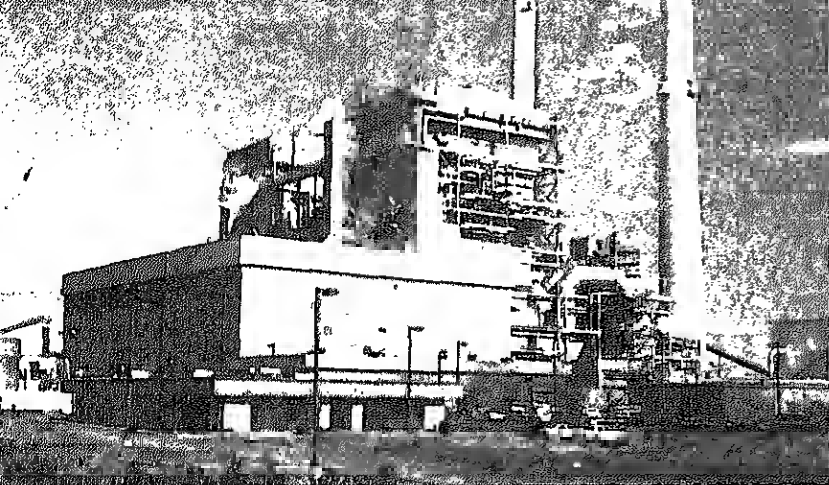
Analyze basic radiation damage events, model mechanisms of material response, and conduct experimental studies involving comparative fission and fusion irradiations.

RECENT TECHNICAL HIGHLIGHTS

High resolution electron microscopy and recently developed microhardness measurement techniques were used to analyze the initiation of microstructural damage in specimens irradiated by fusion energy neutrons. A computer graphics capability was developed for analyzing atomistic damage models.

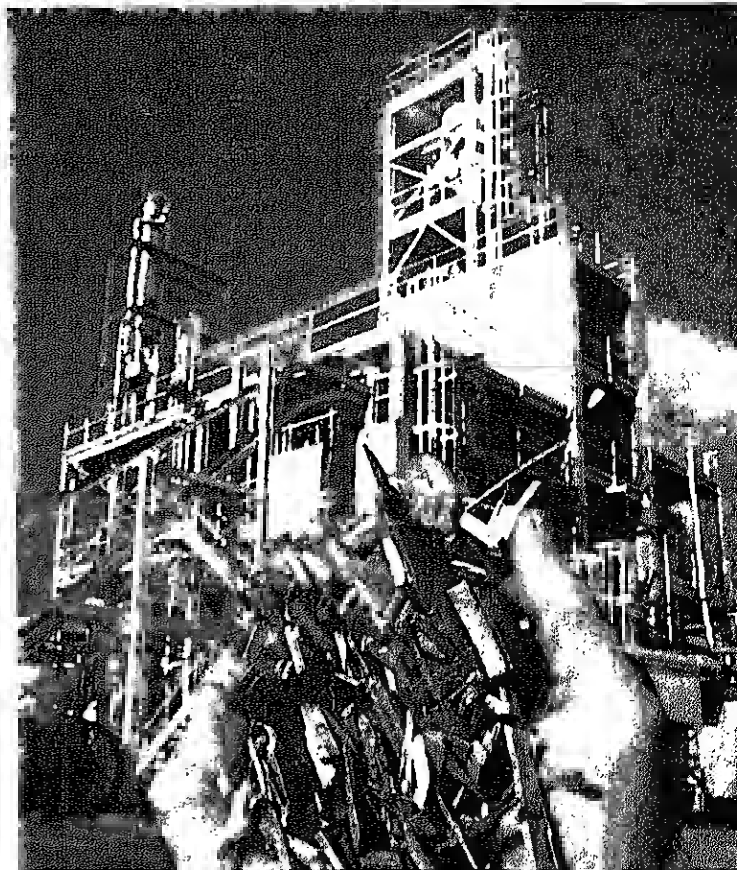
EXPECTED NEAR-TERM ACCOMPLISHMENTS

Atomistic modeling of high energy neutron damage production will be extended to high energy events (several hundred KeV) and computer graphical analyses made. Electron microscopy will begin on specimens irradiated in Oak Ridge Research Reactor and EBR-II to determine helium effects on microstructure.



BIOMASS DEVELOPMENT

Evaluation of
pollution impact
from non-point
sources.



FY-81: \$ 25K

Program: Energy Assessment
Impacts Program
HA-01-03-04

OBJECTIVE

Provide water resource data and analytical support for Energy Assessment Regional Impacts Programs.

SCOPE

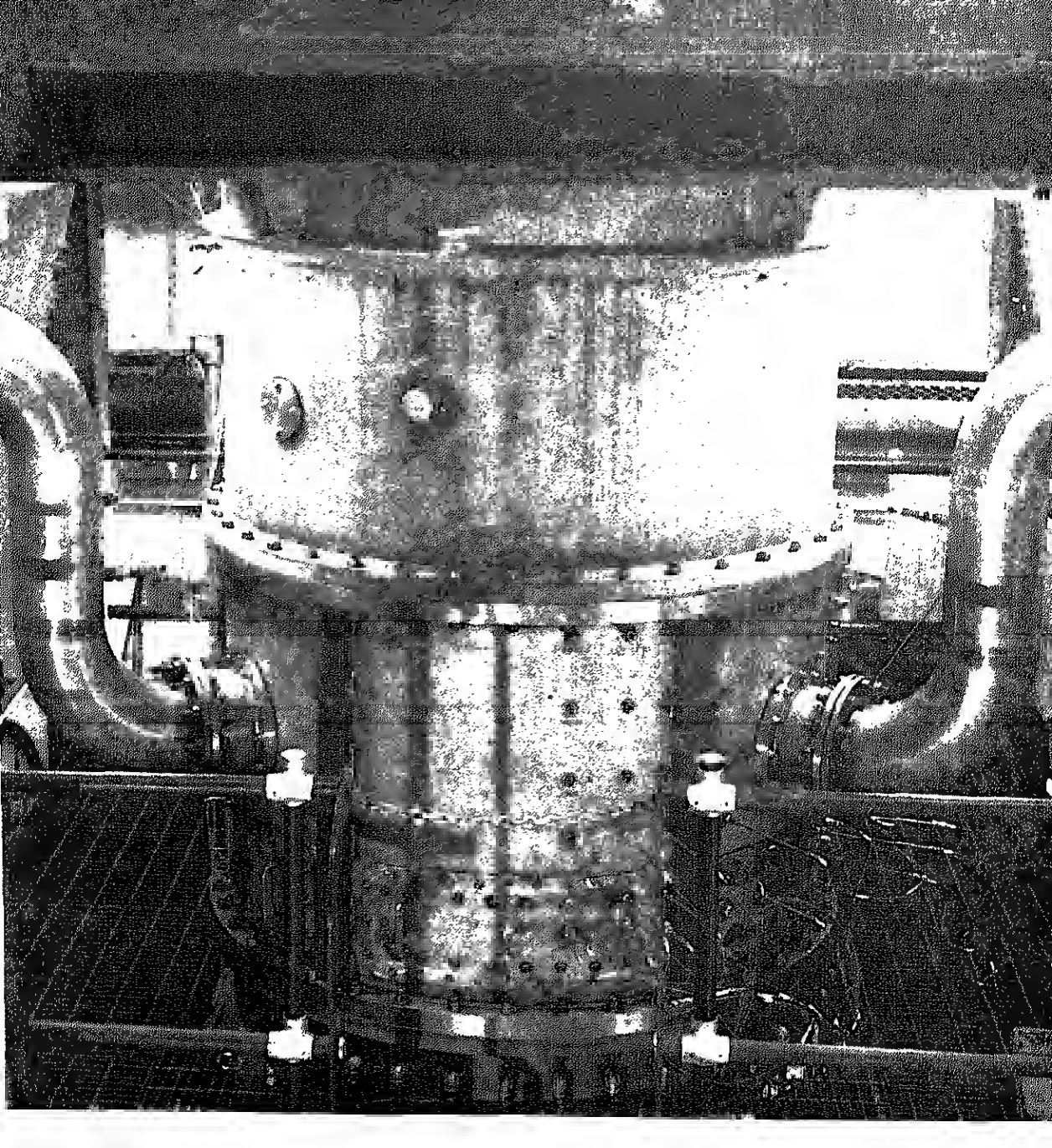
Evaluate the nature and extent of non point pollution impacts expected from energy activities.

RECENT TECHNICAL HIGHLIGHTS

Requested evaluations and water resource data were submitted.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Evaluation of pollution impacts associated with mining, synfuels development and bionuclear development will be completed.



Manager: W.L. Thorne
Sub-Department: Technology

FY-81: \$ 890K

Customer:
Organization: CRBRP
Contact:
Program: Special Request

OBJECTIVE

Provide thermal hydraulic, vibration and mechanical testing of CRBRP reactor systems in accordance with Work Agreements L-274, L-294, and L-295.

SCOPE

CRBRP Reactor Systems Testing at HEDL involves hydraulic and mechanical design verification test programs of reactor vessel internal systems including full-scale fuel and radial blanket assemblies, one-quarter scale inlet plenum and outlet plenum models, and other reactor vessel components under steady state reactor conditions.

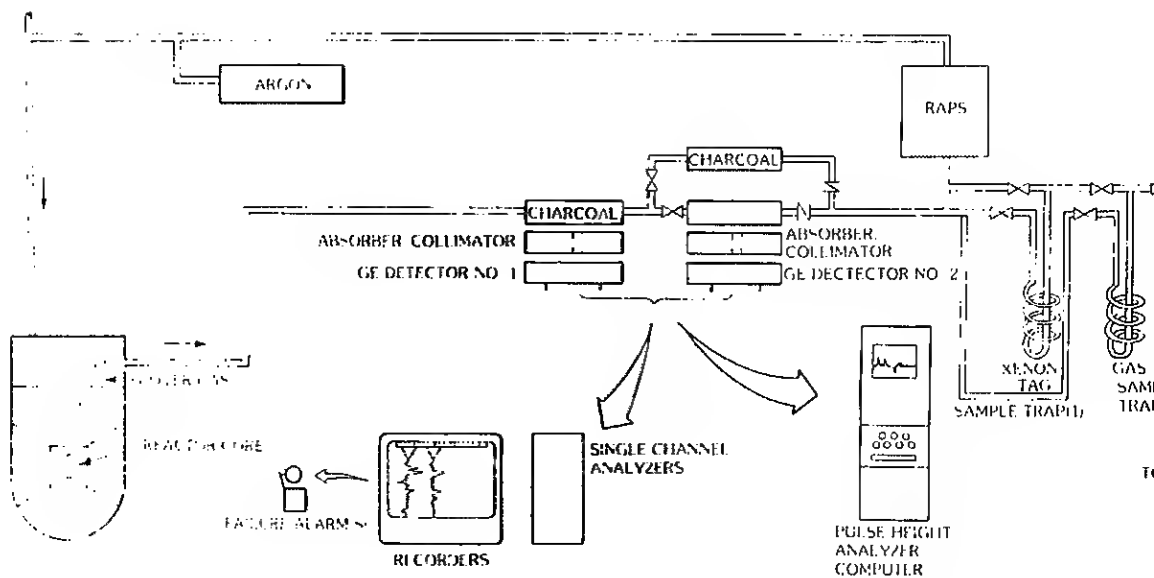
RECENT TECHNICAL HIGHLIGHTS

Completed data reduction and analysis of the original CRBRP Integral Reactor Flow Mode (IRFM) Bypass Thermal Striping tests.

Performed initial CRBRP Duct Bending/Load Pad Strength testing.

Started flow and vibration testing on full scale prototypic CRBRP radial blanket fuel assembly.

COVER GAS MONITORING FOR CRBRP - PRELIMINARY DESIGN



Manager: J.J. McCown
Sub-Department: Technology

FY-81: \$ 90K

Customer:
Organization: CRBRP
Contact:
Program: Special Request

OBJECTIVE

Finalize basic parameters of cover gas Fuel Failure Monitoring sampling and analysis system. Provide engineering consultation services during preliminary design.

SCOPE

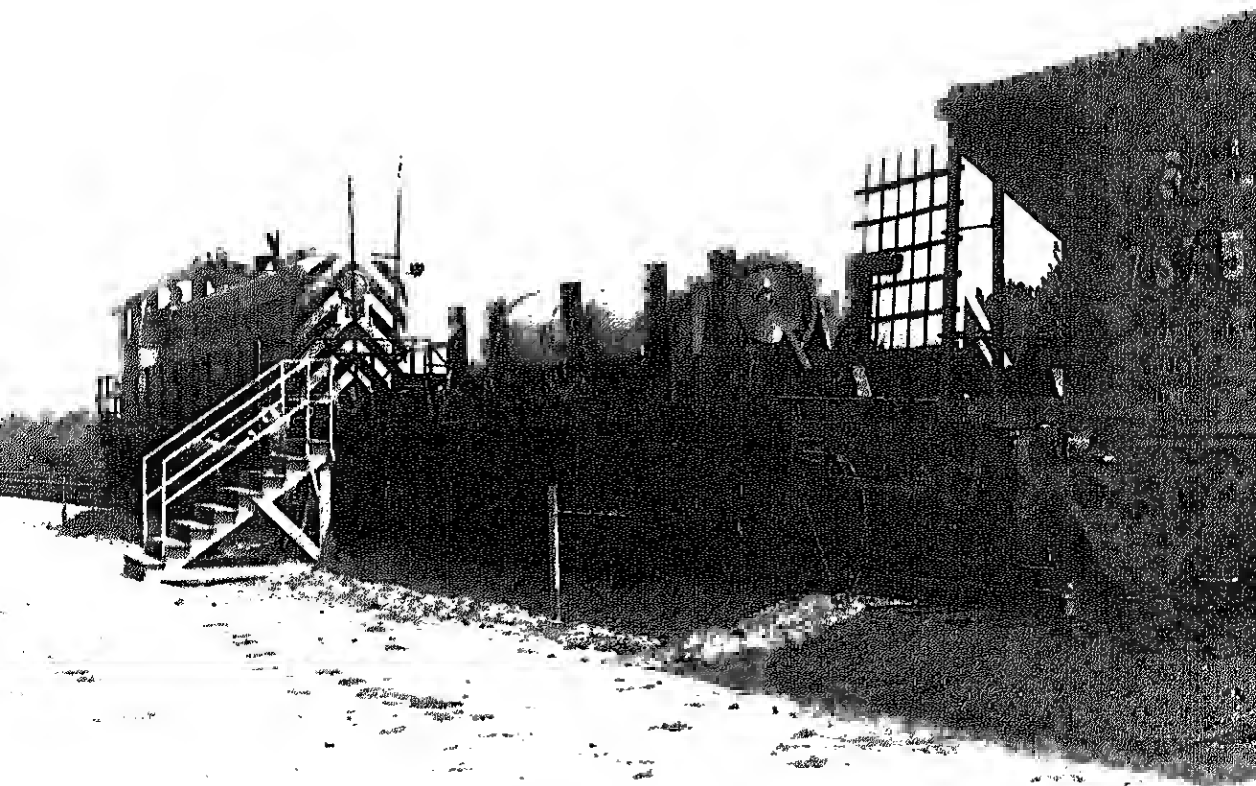
Modify Prooftest Experiment, EX-154, at EBR-II and test suitability of modifications.

Develop computer codes that use mass spectrometric and radiometric analyses to locate and characterize fuel failures.

RECENT TECHNICAL HIGHLIGHTS

Installed HEDL designed thick absorber in position #5 of Detector No. 2's device to improve very high count rate capability.

Tested modified Gamma Ray Subtract (GRS) software for use with compound absorbers, collimators and with thick absorber.



TRANSPORTATION OF SPENT FUEL IN
LWR SHIPPING CASK

OBJECTIVE

Assist in standards development and compliance evaluations for NRC by developing a computer simulation model of the mechanical response of radioactive material shipping packages.

SCOPE

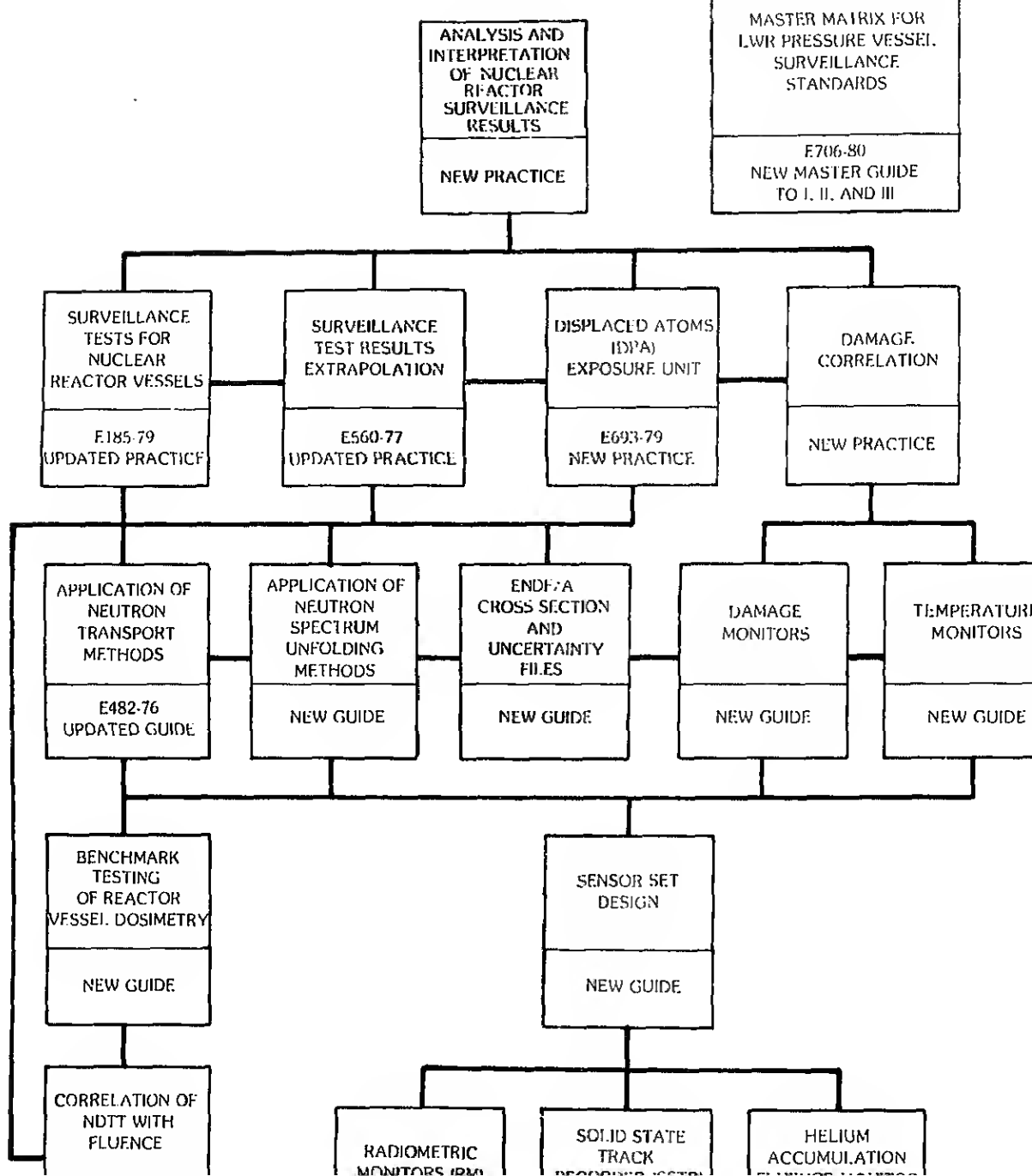
Develop computerized simulation model of mechanical responses of LWR spent fuel shipping casks in normal transport situations. Validate and parametrically extend the model; provide calculated results to apply to standards development.

RECENT TECHNICAL HIGHLIGHTS

Preliminary validation of the computerized simulation model was completed. Parametric and sensitivity analysis were completed.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Complete model validation. Extend parametric and sensitivity analysis and supply data and methodology for purposes of developing regulatory guidelines.



OBJECTIVE

Establish updated and improved ASTM standards for LWR pressure vessel irradiation surveillance, dosimetry, damage correlation, and associated reactor analysis and interpretation procedures.

SCOPE

Prepare and write 17 ASTM recommended standards.

Perform supporting analytical and experimental work: validation and calibration of the recommended ASTM standards using "Standard, Reference, and Controlled Environment Benchmark Neutron Fields," Reactor "Test Regions," and Operating Power Reactor "Surveillance Positions."

RECENT TECHNICAL HIGHLIGHTS

Major physics and dosimetry studies in a low-flux level pressure vessel mockup at ORNL including a "Blind Test" validation of physics calculations involving US and foreign participants, was completed.

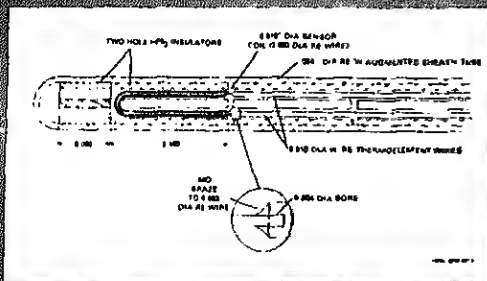
A two-year metallurgical irradiation in a high-flux level pressure vessel mockup at ORNL was started. A shorter irradiation of a mockup surveillance capsule was completed.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Preparation and writing of key ASTM Practice, IA will be completed.

Analysis of samples from the metallurgical irradiation at ORNL will be started. This will validate the accuracy of using surveillance capsule data to make end-of-life predictions for the

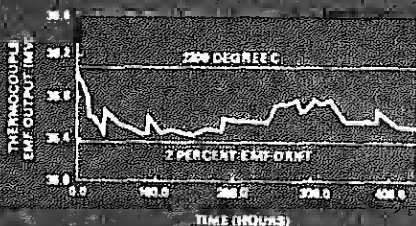
LOFT 2200°C FUEL CENTERLINE JOHNSON NOISE POWER THERMOMETER (JNPT)



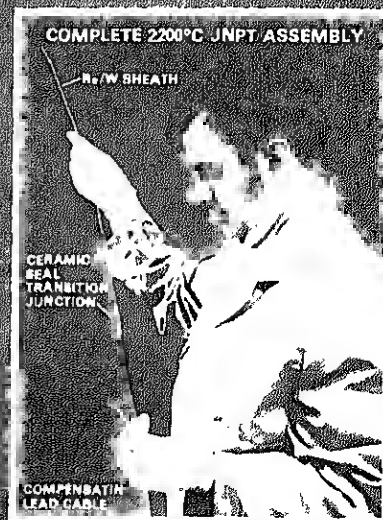
SECTIONAL ILLUSTRATION OF SENSOR JUNCTION



PHOTO OF SENSOR COIL
0.010 IN. DIAMETER WOUND
FROM 0.003 IN. R₀ WIRE



AS A THERMOCOUPLE, IT IS LESS THAN 2%
DRIFT IN 400 HOURS AT 2200°C.



- DUAL JOHNSON NOISE POWER THERMOMETER, THERMOCOUPLE CAPABILITY.
- 4 FT., 1/16 IN. O.D. RUGGED R₀ WIRE PROBE, H₂O₂ INSULATED.
- ABSOLUTE, 'IN SITU' CALIBRATION NOT EFFECTED BY REACTOR TRANSMUTATION EFFECTS.
- CERAMIC-TO-METAL SEAL TRANSITION JUNCTION PREVENTS FISSION GAS ESCAPE - HERMETIC TO 8°C/s THERMAL TRANSIENTS.

Manager: E.M. Sheen
Sub-Department: Reactor Core Supply
FY-81: \$ 164K

Customer:
Organization: NRC
Contact:
Program: Special Request

OBJECTIVE

Develop fuel rod instrumentation for NRC loss-of-flow tests (LOFT Program).

SCOPE

Develop fuel centerline temperature measurement systems to 2200°C, fuel rod gap temperature sensors, plenum pressure sensors, axial motion monitoring sensor and fast plenum thermocouples.

RECENT TECHNICAL HIGHLIGHTS

A fuel centerline temperature measurement system combining a Johnson Noise Power Spectral Density (JNPSD) resistance coil and 2200°C thermocouple was tested in the laboratory. Vector signal processing and fast Fourier transform (FFT) analysis techniques improved fuel rod plenum pressure accuracy during temperature transients by a factor of 2.

SPENT FUEL ASSEMBLY

CONDENSER

FAN AIR OUTLET

VESSEL

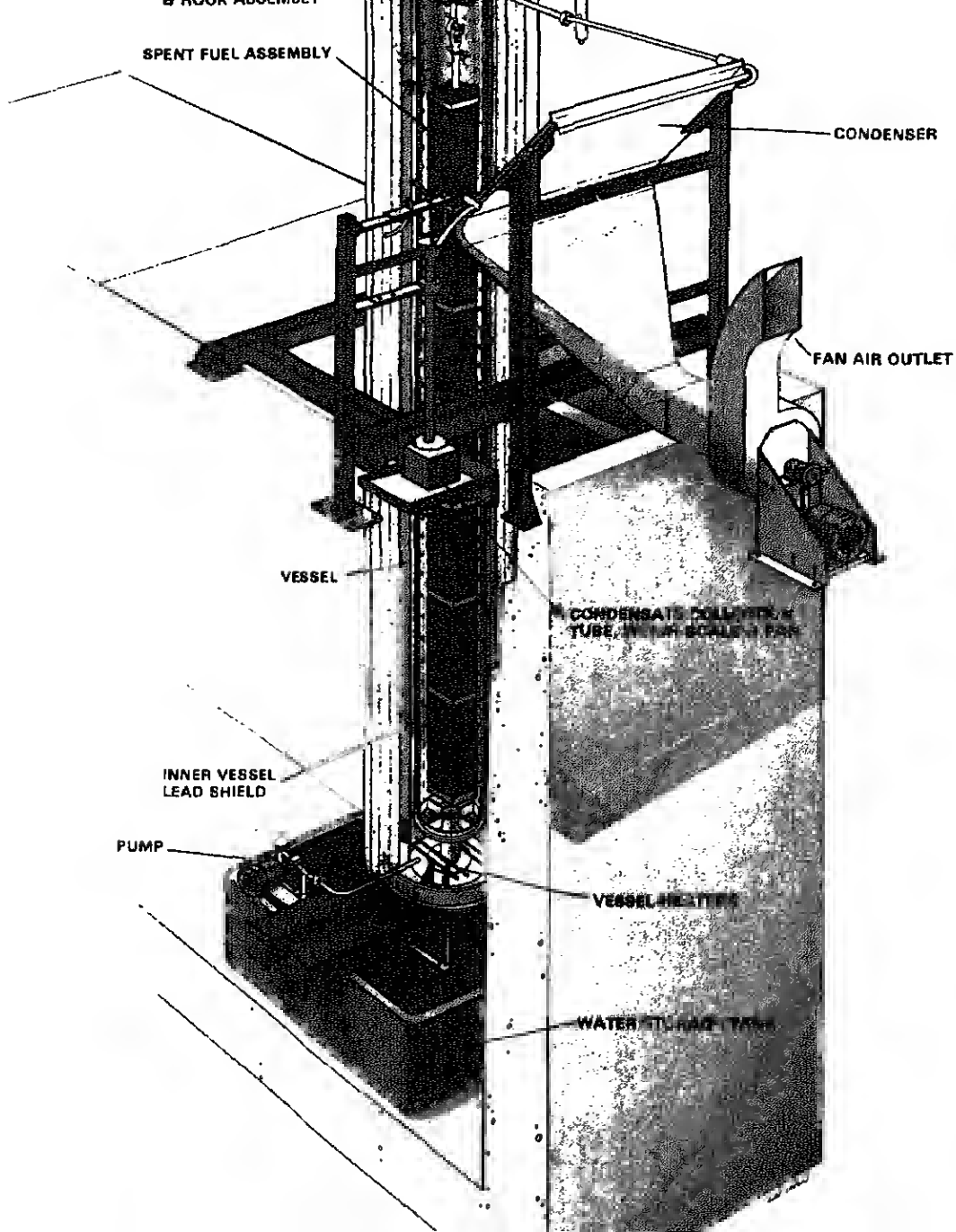
INNER VESSEL
LEAD SHIELD

PUMP

CONDENSATE DRAIN WITH
TUBE, IN LINE SCALE & FAN

VESSEL HEATER

WATER FILLED TANK



OBJECTIVE

Develop technology to select and characterize Unreprocessed Light Water Reactor spent fuel waste forms suitable for isolation in a mined geologic repository.

SCOPE

Develop data bases and theoretical and empirical correlations to characterize and describe the behavior of spent fuel after geologic emplacement in mine repositories. Identify, test, select and qualify stabilizer materials for isolating spent fuel rods in geologic waste packages.

RECENT TECHNICAL HIGHLIGHTS

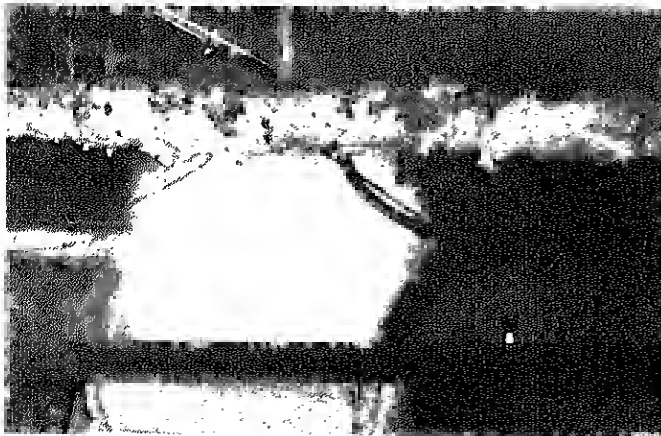
The first known decay heat measurement of a spent fuel assembly was successfully accomplished using a calorimeter designed, fabricated and installed at the Nevada Test Site by PNL and HEDL.

Results from initial elevated temperature whole rod tests show that significant stress relaxation occurs and stress rupture mechanisms can no longer be considered a primary mode for in-repository spent fuel breach.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

The Spent Fuel Engineering program at HEDL was redirected in FY-1981 to evaluate fuel waste form degradation mechanisms which affect long term resistance to release of radionuclides. This work will identify physical and chemical properties of spent fuel, theoretical and

LITHIUM FIRE EXTINGUISHMENT



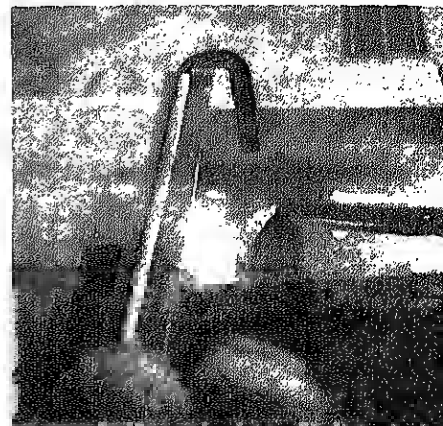
CARBON MICROSPHERES BY SPREADER



CARBONATE BASE POWDER



CARBON MICROSPHERES BY SPRAYER



CARBON MICROSPHERES BY

Manager: L.D. Muhlestein
Sub-Department: Technology

Customer:
Organization: DOE/OFE
Contact:
Program: Special Request

OBJECTIVE

Provide experimental data regarding the use of liquid lithium and alternative breeding and coolant materials in fusion reactors, and maintain research facilities to support safety analysis and design.

SCOPE

Complete lithium reaction scoping studies to include lithium-atmosphere, concrete and insulating material reactions.

Develop and proof test lithium-reaction extinguishment and control techniques.

Determine lithium reaction aerosol behavior and develop and proof test effluent control concepts.

Complete alternate coolant/blanket materials interaction scoping studies.

RECENT TECHNICAL HIGHLIGHTS

Completed lithium reaction scoping studies investigating reactions of lithium with various gaseous atmospheres, various types of concretes, and various insulating materials.

EXPECTED NEAR-TERM ACCOMPLISHMENTS

Complete lithium reaction scoping studies to include lithium-atmosphere and experimentally demonstrate that